

# STOMACH CONTENTS OF FISHES FROM CLEAR LAKE AND TRIBUTARY WATERS, A TEXAS ESTUARINE AREA<sup>1</sup>

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## ABSTRACT

Stomach contents were analyzed from 5,019 bony fishes, representing 40 species, caught during 1958 by trawl in the Clear Lake area, a secondary bay system located one the west side of upper Galveston Bay, Texas.

The most frequently observed items included polychaete annelids, copepods, mysidaceans, penaeid shrimp, river shrimp (*Macrobrachium* sp.), grass shrimp (*Palaemonetes* sp.), plant debris, organic detritus, mud, and sand.

## INTRODUCTION

Most food studies of fishes from estuarine areas have been confined either to a single species or to several abundant species within a single family. Observations on food habits also have been made incidental to general ecological studies or investigations of fish diseases and parasites. Darnell (1958) discussed the foods of fishes and major invertebrates from Lake Pontchartrain, Louisiana. He described two primary food chains. The first leads from micro-crustaceans through small fish, including anchovies (*Anchoa* sp.) and small sciaenids, to the larger predators represented by such species as the longnose gar (*Lepisosteus osseus*) and ladyfish (*Elops saurus*). The second leads from scavenging or filter-feeding benthic invertebrates such as clams, penaeid and palaemonid shrimp, blue crabs (*Callinectes sapidus*), and small bottom-feeding fish, including catfish (*Arius felis*) and young sciaenids, to the same large predators.

This report on the stomach contents of fishes taken from the Clear Lake area is intended as an addition to existing knowledge of feeding habits of fishes from estuaries bordering the Gulf of Mexico. Clear Lake, a small secondary bay on the western side of upper Galveston Bay, has been described by Renfro (1959), Chin (1961), Pullen (1961) and Mock (1965).

## METHODS

Fishes were collected from the Clear Lake area and its tributaries with a 3.0 m (10-ft) otter

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trawl. A 6-mm (0.25-in) bar mesh cover was used over the cod end of the trawl during some of the sampling to capture postlarval fish, many of which were less than 15 mm (0.60 in) in length. The larger bar mesh of the trawl, 19 mm (0.75 in) and 13 mm (0.50 in) in the body and cod end, respectively, permitted many of the smaller fish to escape when the cover was not used.

Sampling was done on an irregular basis throughout 1958. A total of 228 samples was taken from 10 stations (Fig. 1).

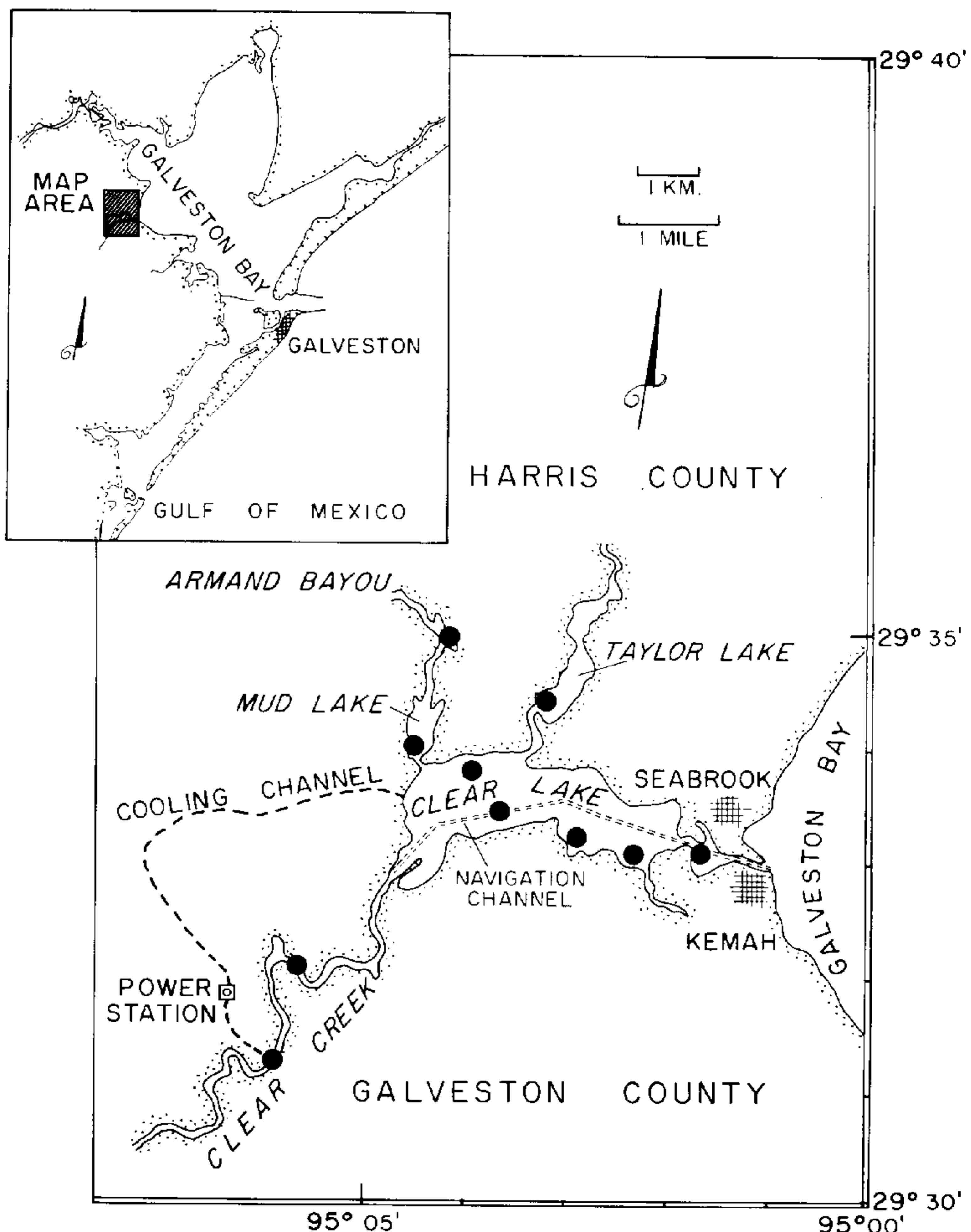


FIG. 1. Sampling stations denoted by large dots in the Clear Lake area, Texas.

Fish samples were placed on ice to impede enzymatic activity. Cooled samples were taken to the laboratory where they were sorted, the fish were measured, and their stomach contents were examined. Standard length (Hubbs and Lagler 1958) was measured in all fishes except two marine catfishes, *Arius felis* and *Bagre marinus*, for which fork length (Lagler 1952) was measured.

Stomach contents of each specimen were sorted and assigned to the lowest taxon which we could accurately identify.

## STOMACH CONTENTS

In the 228 samples taken from the Clear Lake area, 40 species of fish were noted. The presence of items in the stomachs of species examined is shown in Table 1.

The presence of well-defined food chains such as the two primary food chains described by Darnell (1958) for Lake Pontchartrain was not readily apparent in our data. In most species there was considerable overlap of food stages making recognition of distinct feeding stages impossible. The selectivity of the sampling gear used during this study (otter trawl) may be a partial explanation for differences between the results of this study and Darnell's results. The larger fish taken by Darnell with seines and trawls were absent from trawl catches used in this study.

## ACKNOWLEDGMENTS

The authors are indebted to the personnel of the National Marine Fisheries Service, Galveston Laboratory, Galveston, Texas, who participated in the various aspects of this study. The efforts of Gilbert Zamora, Jr., in obtaining material from the field, and of Mrs. Imogene A. Sanderson in sorting and measuring fish are noteworthy.

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TABLE 1  
Contents of stomachs of fishes examined. (X indicates item was present)<sup>1</sup>

	<i>Lepisosteus osseus</i>	<i>Elops saurus</i>	<i>Anchoa mitchilli</i>	<i>Arius felis</i>	<i>Bagre marinus</i>	<i>Fundulus grandis</i>	<i>Fundulus similis</i>	<i>Urophycis floridanus</i>	<i>Syngnathus louisianae</i>	<i>Syngnathus scovelli</i>
Number examined	1	2	4	101	233	1	2	3	3	1
Number with contents	1	2	4	100	205	1	2	3	1	1
Size range (mm)	610	63-80	38-44	37-210	42-118	62	55-59	47-87	155-159	110
Mean length (mm)	610	72	42	67	76	62	57	57	158	110
<b>STOMACH CONTENTS</b>										
Protozoa	..	..	..	..	..	..	..	..	..	..
Foraminifera	..	..	..	..	X	..	..	..	..	..
Nemathelminthes	..	..	..	..	X	..	..	X*	..	..
Nematoda	..	..	..	..	..	..	..	X*	..	..
Annelida	..	..	..	..	..	..	..	..	..	..
Polychaeta	..	..	..	X	X	..	..	..	..	..
Oligochaeta	..	..	..	..	X	..	..	..	..	..
Arthropoda	..	..	..	..	..	..	..	X**	..	..
Crustacea	..	..	..	X	X	..	..	..	X***	..
Ostracoda	..	..	..	X*	X	..	..	..	..	..
Copepoda	..	..	..	X**	X	..	..	..	..	..
Cirripedia	..	..	..	X	X	..	..	..	..	..
Malacostraca	..	..	..	..	..	..	..	..	..	..
Hoplocarida	..	..	..	..	..	..	..	..	..	..
Peracarida	..	..	..	..	..	..	..	..	..	..
Mysidacea	..	..	..	..	..	..	..	..	..	..
Isopoda	..	..	..	..	..	..	..	..	..	..
Amphipoda	..	..	..	X*	X*	..	..	..	X***	..
Eucarida	..	..	..	X	X	..	..	..	..	..
Decapoda	..	..	..	..	..	..	..	..	..	..
Penaeidae	..	..	X*	X	X	..	..	..	X*	..
<i>Penaeus aztecus</i>	..	..	..	..	..	..	..	..	..	..
<i>Penaeus setiferus</i>	..	..	..	..	..	..	..	..	..	..
Palaemonidae	..	..	..	X**	X**	..	..	..	..	..
<i>Palaemonetes</i> sp.	..	..	..	X	X	..	..	..	..	..
<i>Macrobrachium</i> sp.	..	..	..	..	X	..	..	..	..	..
Crangonidae	..	..	..	..	..	..	..	..	..	..
Portunidae	..	..	..	X	X	..	..	..	X*	..
<i>Callinectes sapidus</i>	..	..	..	X	X	..	..	..	..	..
Xanthidae	..	..	..	X	X	..	..	X**	..	..

TABLE 1—Continued

	<i>Lepisosteus osseus</i>	<i>Elops saurus</i>	<i>Anchoa mitchilli</i>	<i>Arius felis</i>	<i>Bagre marinus</i>	<i>Fundulus grandis</i>	<i>Fundulus similis</i>	<i>Urophycis floridana</i>	<i>Syngnathus louisianae</i>	<i>Syngnathus scovelli</i>
Insecta	..	..	..	X	X	..	..	..	..	..
Mollusca	..	..	..	X	..	..	..	..	..	..
Gastropoda	..	..	..	..	..	..	..	..	..	..
Lamellibranchiata	..	..	..	X**	X**	X***	..	..	..	..
Chordata	..	..	..	..	..	..	..	..	..	..
Osteichthyes	..	..	..	..	..	..	..	..	..	..
Clupeidae	..	X***	..	..	..	..	..	..	..	..
<i>Brevoortia patronus</i>	..	X***	..	..	..	..	..	..	..	..
<i>Brevoortia</i> sp.	..	..	..	X	X	..	..	..	..	..
Engraulidae	..	X***	..	..	..	..	..	..	..	..
<i>Anchoa mitchilli</i>	..	X***	..	..	..	..	..	..	..	..
<i>Anchoa</i> sp.	..	..	..	X	X	..	..	..	..	..
Ariidae	..	..	..	..	..	..	..	..	..	..
<i>Bagre marinus</i>	..	..	..	..	X	..	..	..	..	..
Ophichthidae	..	X***	..	..	..	..	..	..	..	..
<i>Myrophis punctatus</i>	..	X***	..	..	..	..	..	..	..	..
Sciaenidae	..	X***	..	..	..	..	..	..	..	..
<i>Cynoscion</i> sp.	..	X***	..	..	..	..	..	..	..	..
<i>Leiostomus xanthurus</i>	..	..	..	..	..	..	..	..	..	..
<i>Micropogon undulatus</i>	..	..	..	..	X	..	..	..	..	..
Sparidae	X***	..	..	..	..	..	..	..	..	..
Mugilidae	..	..	..	..	..	..	..	..	..	..
<i>Mugil cephalus</i>	..	..	..	..	..	..	..	..	..	..
Atherinidae	..	..	..	X	..	..	..	..	..	..
<i>Menidia</i> sp.	..	..	..	X	..	..	..	..	..	..
Bothidae	..	..	..	..	..	..	..	..	..	..
<i>Paralichthys lethostigma</i>	..	..	..	..	..	..	..	..	..	..
Miscellaneous items	..	..	..	X	X	..	..	..	..	..
Algae	..	..	..	X*	X	..	..	..	..	..
Vascular plants	..	..	..	X*	X	..	..	..	..	..
Eggs and cysts	..	..	..	X*	X	..	..	..	..	..
Organic detritus	..	..	..	X	X	..	..	..	..	..
Mud and sand	..	..	..	X	X	..	..	..	..	..

TABLE 1—Continued

	<i>Morone chrysops</i>	<i>Oligoplites saurus</i>	<i>Pogonias cromis</i>	<i>Cynoscion arenarius</i>	<i>Cynoscion nebulosus</i>	<i>Bairdiella chrysura</i>	<i>Sciaenops ocellata</i>	<i>Leiostomus xanthurus</i>	<i>Micropogon undulatus</i>	<i>Stellifer lanceolatus</i>
Number examined	1	9	7	1,041	60	45	59	468	2,342	6
Number with contents	1	2	7	886	50	36	51	406	2,131	6
Size range (mm)	121	50–60	131–163	23–160	35–230	30–96	38–222	18–165	10–165	53–85
Mean length (mm)	121	55	141	61	96	63	60	60	46	67
<b>STOMACH CONTENTS</b>										
Protozoa	..	..	..	..	..	..	..	X*	X	..
Foraminifera	..	..	..	..	..	..	..	..	..	..
Nemathelminthes	..	..	X	X	X	..	X*	X	X	..
Nematoda	..	..	..	..	..	..	..	X	X	..
Annelida	..	..	X	X	..	..	X	X	X	..
Polychaeta	..	..	..	..	..	..	..	..	..	..
Oligochaeta	..	..	..	..	..	..	..	..	..	..
Arthropoda	..	..	..	X	X	..	X	X	X	..
Crustacea	..	..	..	X	X	X*	X	X	X	..
Ostracoda	..	..	..	X	X	X*	X	X	X	..
Copepoda	..	..	..	..	..	..	..	..	..	..
Cirripedia	..	..	..	X	..	..	..	..	..	..
Malacostraca	..	..	..	..	..	..	..	..	X	..
Hoplocarida	..	..	..	X	..	..	..	..	X	..
Peracarida	..	..	X*	X**	X*	X***	X	X	X	..
Mysidacea	..	..	X**	X	X	X	X	X	X	..
Isopoda	..	..	..	..	..	..	..	X	X	..
Amphipoda	..	..	..	..	..	..	..	..	X	..
Eucarida	..	..	..	X	X	X	X	X	X	..
Decapoda	..	..	..	X	X	X	X	X	X	..
Penaeidae	..	..	..	X	X	X	X	X	X	..
<i>Penaeus aztecus</i>	..	..	..	X	X	X	X	X	X	..
<i>Penaeus setiferus</i>	..	..	..	X	X	X	X	X	X	..
Palaemonidae	..	..	..	X*	X	X	X	X	X	..
<i>Palaemonetes</i> sp.	..	..	..	..	..	..	..	..	..	..
<i>Macrobrachium</i> sp.	..	..	..	..	..	..	..	..	..	..
Crangonidae	..	..	..	..	..	..	..	..	..	..
Portunidae	..	..	X*	X	X	..	..	X	X	..
<i>Callinectes sapidus</i>	..	..	X	X	X	..	..	X	X	..
Xanthidae	X***	..	..	X	X	..	..	X	X	..

TABLE 1—Continued

	<i>Roccus chrysops</i>	<i>Oligoplites saurus</i>	<i>Pogonias cromis</i>	<i>Cynoscion arenarius</i>	<i>Cynoscion nebulosus</i>	<i>Bairdiella chrysura</i>	<i>Sciaenops ocellata</i>	<i>Leiostomus xanthurus</i>	<i>Micropogon undulatus</i>	<i>Stellifer lanceolatus</i>
Insecta	..	..	..	..	..	..	..	..	X	..
Mollusca	..	..	..	..	..	..	..	X	X	..
Gastropoda	..	..	..	..	..	..	..	X	X	..
Lamellibranchiata	..	..	X	X	X*	X	X*	X	X	X*
Chordata	..	X***	..	..	..	..	..	..	..	..
Osteichthyes	..	..	..	..	..	..	..	..	X	..
Clupeidae	..	..	X	..	X	..	X*	..	..	..
<i>Brevoortia patronus</i>	..	..	X	..	X	..	..	..	..	..
<i>Brevoortia</i> sp.	..	..	..	..	..	..	..	..	..	..
Engraulidae	..	..	..	X	X	..	..	..	X	..
<i>Anchoa mitchilli</i>	..	..	..	X	X	..	..	..	..	..
<i>Anchoa</i> sp.	..	..	..	..	..	..	..	..	..	..
Ariidae	..	..	..	..	..	..	..	..	..	..
<i>Bagre marinus</i>	..	..	..	..	..	..	..	..	X	..
Ophichthidae	..	..	X	..	X	..	X	..	X	..
<i>Myrophis punctatus</i>	..	..	..	..	..	..	..	..	X	..
Sciaenidae	..	..	..	..	..	..	..	..	X	..
<i>Cynoscion</i> sp.	..	..	..	..	..	..	..	..	X	..
<i>Leiostomus xanthurus</i>	..	..	..	..	..	X	..	..	..	..
<i>Micropogon undulatus</i>	..	..	..	..	..	..	..	..	X	..
Sparidae	..	..	..	..	..	..	..	..	..	..
Mugilidae	..	..	..	..	..	..	..	..	X	..
<i>Mugil cephalus</i>	..	..	..	..	..	..	..	..	..	..
Atherinidae	..	..	..	..	..	..	..	..	..	..
<i>Menidia</i> sp.	..	..	..	..	..	..	..	..	X	..
Bothidae	..	..	..	..	..	..	..	..	..	..
<i>Paralichthys lethostigma</i>	..	..	..	..	..	..	..	..	..	..
Miscellaneous items										
Algae				X	X	X	X	X	X	X*
Vascular plants	X***	..	..	X	X	X	X	X	X	X*
Eggs and cysts	..	..	..	X	X	X	X	X	X	X
Organic detritus	..	..	..	X	X	X	X	X	X	X
Mud and sand	..	..	..	X	X	X	X	X	X	X

TABLE 1—Continued

TABLE 1—Continued

	<i>Lagodon rhomboides</i>	<i>Chaetodipterus faber</i>	<i>Trichiurus lepturus</i>	<i>Gobioides broussonneti</i>	<i>Gobionellus boleosoma</i>	<i>Gobionellus hastatus</i>	<i>Gobionellus shufeldti</i>	<i>Gobiosoma boscii</i>	<i>Prionotus tribulus</i>	<i>Astroscopus y-graecum</i>
Insecta	..	X	..	..	..	..	..	..	..	..
Mollusca	..	X	..	..	..	..	..	X	..	..
Gastropoda	..	..	..	..	..	..	..	..	..	..
Lamellibranchiata	X	..	..	..	..	..	..	..	..	..
Chordata	..	..	..	..	..	..	..	..	..	..
Osteichthyes	X	X	..	..	..	..	..	..	X	X***
Clupeidae	..	..	..	..	..	..	..	..	..	..
<i>Brevoortia patronus</i>	..	..	..	..	..	..	..	..	..	..
<i>Brevoortia</i> sp.	..	..	..	..	..	..	..	..	..	..
Engraulidae	..	..	..	..	..	..	..	..	..	..
<i>Anchoa mitchilli</i>	..	..	..	..	..	..	..	..	..	..
<i>Anchoa</i> sp.	..	..	..	X*	..	..	..	..	..	..
Ariidae	..	..	..	X*	..	..	..	..	..	..
<i>Bagre marinus</i>	..	..	..	..	..	..	..	..	..	..
Ophichthidae	..	..	..	..	..	..	..	..	..	..
<i>Myrophis punctatus</i>	..	..	..	..	..	..	..	..	..	..
Sciaenidae	..	..	..	..	..	..	..	..	..	..
<i>Cynoscion</i> sp.	..	..	..	..	..	..	..	..	..	..
<i>Leiostomus xanthurus</i>	..	..	..	..	..	..	..	..	..	..
<i>Micropogon undulatus</i>	..	..	..	..	..	..	..	..	..	..
Sparidae	..	..	..	..	..	..	..	..	..	X
Mugilidae	..	..	..	..	..	..	..	..	..	..
<i>Mugil cephalus</i>	..	..	..	..	..	..	..	..	..	..
Atherinidae	..	..	..	..	..	..	..	..	..	..
<i>Menidia</i> sp.	..	..	..	..	..	..	..	..	..	..
Bothidae	..	..	..	..	..	..	..	..	..	..
<i>Paralichthys lethostigma</i>	..	..	..	..	..	..	..	..	..	..
Miscellaneous items										
Algae	X	X**	..	..	..	..	..	..	X	..
Vascular plants	X	X****	..	X**	..	..	X*	X	X	..
Eggs and cysts	X*	..	..	X*	X**	..	..	..	..	..
Organic detritus	X*	..	..	X*	X**	..	..	X	X	..
Mud and sand	X	X**	..	..	..	X***	X**	X*	X	..

TABLE 1—Continued

TABLE 1—Continued

	<i>Polydactylus octonemus</i>	<i>Menidia beryllina</i>	<i>Paralichthys lethostigma</i>	<i>Citharichthys spilopterus</i>	<i>Achirus lineatus</i>	<i>Trinectes maculatus</i>	<i>Syphurus plagiura</i>	<i>Cobiesox strumosus</i>	<i>Sphaeroides parvus</i>	<i>Opsanus beta</i>
Insecta	..	..	..	..	X	..	..	..	..	..
Mollusca	..	..	..	..	..	..	..	..	..	..
Gastropoda	..	..	..	..	..	..	..	..	..	..
Lamellibranchiata	..	..	..	..	..	..	..	..	..	..
Chordata	..	..	..	..	..	..	..	..	..	..
Osteichthyes	..	..	..	..	..	..	..	..	..	..
Clupeidae	..	..	X	X	..	..	X	..	X*	X
<i>Brevoortia patronus</i>	X***	..	..	..	..	..	..	..	..	..
<i>Brevoortia</i> sp.	..	..	..	..	..	..	..	..	..	..
Engraulidae	..	..	..	..	..	..	..	..	..	..
<i>Anchoa mitchilli</i>	..	..	..	..	..	..	..	..	..	..
<i>Anchoa</i> sp.	..	..	..	..	..	..	..	..	..	..
Ariidae	..	..	..	..	..	..	..	..	..	..
<i>Bagre marinus</i>	..	..	..	..	..	..	..	..	..	..
Ophichthidae	..	..	..	..	..	..	..	..	..	..
<i>Myrophis punctatus</i>	..	..	..	..	..	..	..	..	..	..
Sciaenidae	..	..	..	..	..	..	..	..	..	..
<i>Cynoscion</i> sp.	..	..	..	..	..	..	..	..	..	..
<i>Leiostomus xanthurus</i>	..	..	X	..	..	..	..	..	..	..
<i>Micropogon undulatus</i>	..	..	..	..	..	..	..	..	..	..
Sparidae	..	..	..	..	..	..	..	..	..	..
Mugilidae	..	..	..	..	..	..	..	..	..	..
<i>Mugil cephalus</i>	..	..	..	..	..	..	..	..	..	..
Atherinidae	..	..	..	..	..	..	..	..	..	..
<i>Menidia</i> sp.	..	..	..	..	..	..	..	..	..	..
Bothidae	..	..	..	..	..	..	..	..	..	..
<i>Paralichthys lethostigma</i>	..	..	X	..	..	..	..	..	..	..
Miscellaneous items	..	..	..	..	..	X	X	X	X*	..
Algae	..	..	..	..	..	..	..	..	..	..
Vascular plants	..	..	..	X	X	X	X	..	X*	..
Eggs and cysts	..	..	..	..	X	..	..	..	..	..
Organic detritus	..	X***	..	..	X*	X	X*	..	..	..
Mud and sand	..	..	..	X	X*	X**	..	..	X*	X*

<sup>1</sup> Triple asterisks (\*\*\*), indicate item was present in 75% or more of stomachs with contents; double asterisks (\*\*) indicate item was present in 50-74.9% of stomachs with contents; and single asterisks (\*) indicate item was present in 25-49.9% of stomachs with contents. No asterisks indicate item was present in fewer than 25% of stomachs with contents.